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ABSTRACT

This report presents the results of a review of the government-university partnership in research and associated educational activities undertaken by a multi-agency task force under the auspices of the National Science and Technology Council (NSTC), focusing on ways to strengthen this partnership. The task force solicited the views of universities, university associations. and federal research agencies regarding the issues they considered most pressing. The review found that the government-university partnership in research is sound and continues to serve the nation in important ways. To help strengthen this partnership, the NSTC is issuing a proposed statement of the principles of the partnership to clarify the roles, responsibilities, and expectations of the parties and to provide a framework for the development and analysis of future policies, rules, regulations, and laws. The NSTC will also take specific actions, through federal agencies that fund university-based research, to make the partnership more effective and efficient, focusing on areas such as research integrity, merit review, cost-sharing policies and practices, grants administration, and regulation. Two appendixes list NSTC task force and working group members. (MDM)

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ED 434 590

Renewing the Federal Government-University Research Partnership for the 21st Century

National Science and Technology Council
NSTC Presidential Review Directive – 4

Executive Office of the President
Office of Science and Technology Policy

April 1999

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About the National Science and Technology Council

President Clinton established the National Science and Technology Council (NSTC) by Executive Order on November 23, 1993. This Cabinet-level council is the principal means for the President to coordinate science, space and technology policies across the Federal Government. NSTC acts as a "virtual" agency for science and technology to coordinate the diverse parts of the Federal research and development enterprise. The NSTC is chaired by the President. Membership consists of the Vice President, Assistant to the President for Science and Technology, Cabinet Secretaries and Agency Heads with significant science and technology responsibilities, and other White House officials.

An important objective of the NSTC is the establishment of clear national goals for Federal science and technology investments in areas ranging from information technologies and health research to improving transportation systems and strengthening fundamental research. The Council prepares research and development strategies that are coordinated across Federal agencies to form an investment package that is aimed at accomplishing multiple national goals.

To obtain additional information regarding the NSTC, contact the NSTC Executive Secretariat at (202) 456-6100.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization and Priorities Act of 1976. OSTP's responsibilities include advising the President in policy formulation and budget development on all questions in which science and technology are important elements; articulating the President's science and technology policies and programs; and fostering strong partnerships among Federal, State and local governments, and the scientific communities in industry and academe.

Renewing the Federal Government-University Research Partnership for the 21st Century

THE WHITE HOUSE

WASHINGTON

Dear Colleague:

I am pleased to transmit the National Science and Technology Council (NSTC) report, *Renewing the Federal Government-University Research Partnership for the 21st Century*. A multi-agency task force developed the report under the auspices of the NSTC Committee on Science. The NSTC review of the Federal-government-university research partnership, conducted under Presidential Review Directive - 4, illustrates the Administration's commitment to universities.

The goals of the NSTC review were examine the underlying principles of the partnership, promote cost-effective university-based research, and ensure fair allocation of research costs, all while maintaining appropriate accountability for expenditure of public funds. A special emphasis was placed on strengthening the linkage between research and education. The review found that the partnership between the Federal government and universities in research and associated educational activities continues to prove vital and exceptionally productive. The partnership continues to promote the discovery of knowledge, stimulate technological innovation, improve the quality of life, educate the next generation of scientists and engineers, and contribute to America's economic prosperity. The recommendations included in this report will help strengthen the partnership and foster its continued vitality into the 21st century.

The first recommendation commits the NSTC to the development of a statement of principles of the partnership to improve mutual understanding among the stakeholders and strengthen the effectiveness of the partnership. As a first step, the NSTC is issuing a proposed set of principles that will be refined over the next year through discussion among stakeholders, including the Congress, the university community, and professional societies. Some of these discussions will be organized through the NSTC, but I also urge independent discussion in the university community. The principles set forth in this document can fundamentally shape our thinking and our actions with respect to the government-university partnership. I urge all stakeholders to become involved in the discussion and will work to ensure that the proposed principles receive thorough and fair consideration.

A second set of recommendations addresses a central and unique role of universities: the education and training of the next generation of scientists and engineers. Government policies and practices must recognize the dual roles of both graduate and undergraduate students as both researchers who contribute to the national research enterprise and as students who gain experience as part of their training. I am committed to pursuing the necessary changes in Federal rules and regulations to bring our policies into better accord with practice in this area and urge universities to do the same.

The NSTC is also committed to a set of actions outlined in the report that will help make the partnership more effective and efficient in areas identified by the review. I will ensure that all follow-up activities are taken up expeditiously.

Finally, I will establish an NSTC standing interagency working group under the auspices of the Committee on Science that is dedicated to continuing review and assessment of the government-university partnership.

The task force chair and working group are commended for their efforts in the development of this report.

Sincerely,

Neal Lane

Neal Lane
Assistant to the President
for Science and Technology

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

The partnership in science and technology that has evolved between the Federal government and American universities has yielded benefits that are vital to each. It continues to prove exceptionally productive, successfully promoting the discovery of knowledge, stimulating technological innovation, improving the quality of life, educating and training the next generation of scientists and engineers, and contributing to America's economic prosperity. As with all successful partnerships, it is occasionally appropriate to review and reaffirm the partnership and find ways to strengthen it.

At the urging of the President's Committee of Advisors on Science and Technology, state governors, industry leaders, elected officials, and leaders in education, the Assistant to the President for Science and Technology issued a Presidential Review Directive in September 1996, directing the National Science and Technology Council (NSTC) to review the government-university partnership in research and associated educational activities, and to recommend ways to strengthen it. The goal was to assess and reaffirm the principles of the partnership, promote cost-effective university-based research, ensure fair allocation of research costs, and support the linkage between research and education, all while maintaining appropriate accountability for expenditure of public funds. Where appropriate, the findings and recommendations emerging from this review also apply to nonprofit independent research institutes.

The review was carried out by a multiagency Task Force under the auspices of the NSTC Committee on Science. The Task Force solicited the views of universities, university associations, and the Federal research agencies regarding the issues they considered most pressing. These responses provided the basis for the interagency discussions and for the report's findings and recommendations.

The NSTC finds that the partnership is sound and continues to serve the nation in important ways. The NSTC identified a number of areas in which the partnership can be strengthened and will take action in three areas. ***First***, the NSTC is issuing a proposed statement of the principles of the partnership to clarify the roles, responsibilities, and expectations of the parties and provide a framework for the development and analysis of future policies, rules, regulations, and laws. The principles will be finalized, in consultation with universities and other interested parties, including the Congress, within twelve months from the date this report is issued. ***Second***, the NSTC reaffirms the importance to the nation, to the research enterprise, and to the future scientific and engineering workforce, of the linkage between research and education. The NSTC will take actions to strengthen this linkage, and urges universities to do likewise. ***Third***, the NSTC, through the Federal agencies that fund university-based research, will implement a set of actions to help make the partnership more effective and efficient. ***Finally***, the NSTC will establish a mechanism to provide for ongoing review of the partnership.

CHAPTER 1

INTRODUCTION

American universities are a key component of our world-class research system, contributing to the development of knowledge and helping to advance societal goals. Our universities are the envy of the world, built as they are on a commitment to excellence. They have proven to be an exceptionally rich setting for the conduct of research because they are committed to the dual purpose of generating knowledge as well as educating the next generation of scientists and engineers.

Observers of the science and technology enterprise often look to Vannevar Bush's 1945 treatise *Science—The Endless Frontier*, to explain the origins of the Federal government's commitment to research and education. But the history of these endeavors goes back even further. The fact that the United States has flourished, notwithstanding profound internal and external challenges, is partly attributable to our willingness as a nation to invest significant public resources for public goods not readily attainable by the normal workings of the marketplace. Our earliest declaration of national purpose commits us to promoting "the progress of science and useful arts," a commitment which we honored immediately in 1790 with the first decennial U.S. Census. The census was followed by an historically unprecedented and nationally funded scientific reconnaissance of our landscape – its topography, geography, flora and fauna, wildlife, native peoples, land routes and waterways – which enabled citizens and entrepreneurs to realize the economic promise of our vast continent throughout much of the nineteenth century.

The manner in which we have chosen as a nation to invest in scientific and engineering research has, not surprisingly, reflected the pluralism of our communities and the decentralized structure of our governing institutions. The Federal government has relied on approaches as varied as the country itself to promote science and engineering. The advance of science and technology has often been coupled with other public objectives – especially education. The Johns Hopkins University and Clark University, our first explicitly research-oriented universities, were founded in 1876 and 1887. Since then, universities have served not only as critical research locations, but as a training ground for the next generation of scientists and engineers. The close coupling of research and education has become a hallmark of the U.S. system of higher education, producing the finest scientists and engineers prepared to perform cutting edge research and to manage high-technology enterprises across a broad range of disciplines and in multiple venues.

The partnership in research that has evolved between the Federal government and American universities has yielded benefits that are vital to each. It continues to prove exceptionally productive, successfully promoting the discovery of knowledge, stimulating technological innovation, improving the quality of life, educating the next generation of scientists and engineers, and contributing to America's economic prosperity.

While the wisdom of investments in research has proven itself repeatedly over time, each era brings with it special challenges and opportunities. Neither universities nor the Federal government have remained immune from the historic shifts that have taken place in the last decade, including the globalization of the economy; the growing interdependence of the economy and scientific and technical advances; the increasing reliance of industry on universities for the performance of basic research; and the continuing importance of research universities to the economic prosperity of states and regions. The partnership between the Federal government and the nation's research universities must evolve along with these changes, making this an appropriate time to review the fundamental principles of the partnership, renew the government's commitment to it, and suggest how the partnership might be strengthened so that it can continue to be effective and efficient and serve the nation into the next century.

It was in this context that the Assistant to the President for Science and Technology, at the urging of the President's Council of Advisors on Science and Technology, state governors, industry leaders, elected officials, and leaders in education, issued a Presidential Review Directive in September 1996 directing the National Science and Technology Council (NSTC) to review the government-university partnership and recommend ways to strengthen it. As noted above, where appropriate, the findings and recommendations emerging from this review also apply to nonprofit independent research institutes. The NSTC was charged to assess the policies, programs, and regulations that shape the partnership, associated educational activities, and the administration of research. The goal was to review the principles of the partnership, promote cost-effective university-based research, ensure fair allocation of research costs, and support the linkage between research and education, all while maintaining appropriate accountability for expenditure of public funds.

The review was carried out by a multiagency Task Force chaired by the Associate Director for Science of the Office of Science and Technology Policy, with the support of a Working Group, under the auspices of the NSTC Committee on Science. The review findings and recommendations, documented in this report, are based on inputs from universities, university associations, and the Federal research agencies received in response to a Task Force solicitation. The Working Group

reviewed over 40 university and university association responses, representing hundreds of universities. The Federal Demonstration Partnership (FDP), a cooperative agreement among 65 academic institutions (including administrators and faculty representatives), 11 Federal agencies, and six affiliate members designed to enhance research productivity and reduce administrative burden while maintaining appropriate stewardship of public funds, offered valuable input and is expected to assist in implementation of the recommendations. The Government-University-Research Roundtable of the National Academies of Sciences and Engineering and the Institute of Medicine, is the official convener of the FDP. The Government-University-Industry Research Roundtable, with its record of inquiry into areas of concern to this review, also provided valuable input to this review. So did the National Science Board, particularly on the role of the Federal government in graduate and postdoctoral education.

CHAPTER 2

FINDINGS AND RECOMMENDATIONS

The NSTC finds that the partnership is sound, that it continues to serve the nation in important ways, and provides a sound basis for the transition of the partnership into the twenty-first century. The partnership contributes to America's economic prosperity, enhances national security, and provides the means to improve the quality of life for our citizens. The integration of research with education, effective teaching and mentoring, and awards based on merit provide the underpinnings of the system.

Federally supported university-based research is a critically important investment by the nation in its future prosperity and wellbeing. Federal investments in university-based research are an integral component of the larger research and development enterprise that has enabled approximately half of the nation's productivity and growth in the last 50 years. In 1997, the Federal government provided $14.2 billion for academic research. These funds comprise more than 60% of support from all sources for university research, and account for more than half of Federal investments in basic research, and more than one-third of its investment in total research (basic and applied). Those fractions are more than are received by any other type of research performer. They reveal the extent of the nation's reliance on universities as the prime repository of core competency in basic research and underscore the importance placed by Federal agencies on coupling research and education in preparing the next generation of scientists and engineers. Federal agencies foster science and technology partnerships with universities in numerous other ways, such as providing university-based researchers access to unique, state-of-the art research facilities. These facilities provide essential research tools for a wide range of disciplines and foster collaborative research relationships between researchers in Federal laboratories, industrial partners, and university students and faculty.

The NSTC found great encouragement in the ongoing and dynamic partnership between government and universities. But while the NSTC concluded that the partnership remains productive, maintaining its vitality requires continued vigilance. The review identified a number of ways in which the partnership might be made more effective and is taking action in three areas outlined chapters 3-5. Chapter 6 addresses the need for ongoing review of the partnership. ***First***, the NSTC concludes that mutual understanding and effectiveness would be enhanced by a clear articulation of the principles of the partnership. The NSTC will develop such a statement of principles in consultation with universities, and as a first step, is issuing a proposed set of principles, reproduced in chapter 3. To be effective, this process

must be conducted in partnership with stakeholders, including the Congress. ***Second***, the NSTC reaffirms the importance to the nation, to the research enterprise, and to the future scientific and engineering workforce, of linking education and research, and urges universities to do likewise. The vital and dual roles of students (undergraduates as well as graduates), as both researchers who contribute to the national research enterprise, and as students who gain research experience as part of their training, must be recognized and reflected in government and university policies and practices alike. Specific actions that the NSTC will take in support of this policy are outlined in chapter 4. ***Third***, the NSTC, through the agencies that fund university-based research, will implement a set of actions that will help make the partnership more effective and efficient in areas identified by the review and discussed in chapter 5 of the report. Universities are likewise urged to examine their policies and practices for ways to improve the partnership. ***Finally***, the NSTC will establish a mechanism to follow-up on issues that were identified by the review but which were not examined in detail and to provide for ongoing review of the partnership.

CHAPTER 3

PRINCIPLES OF THE FEDERAL PARTNERSHIP WITH UNIVERSITIES IN RESEARCH

For the partnership to thrive, there must be a clear understanding on the part of both parties of the goals of the partnership and the responsibilities of the partners. Why does the Federal government invest in university research? What is the role of graduate students in the research enterprise? On what basis are the costs of research allocated among the parties? Federal laws, circulars, and regulations govern operational aspects of the government-university relationship in areas such as allowable costs, administrative procedures, compliance issues, and audit practices. Yet statements of the rationale, goals, and objectives of the public investment in university-based research remain implicit, or are dispersed in a variety of legislative and other documentation. As long as this is so, the government-university partnership risks being defined primarily in an ad hoc manner, by detailed accounting, administrative, and financial management requirements, and not by broader national goals.

A clearly articulated statement of the principles of the partnership would help clarify the roles, responsibilities, and expectations of each of the partners and establish a framework for addressing future issues as they arise. Ultimately, an agreed upon statement of principles would also serve to shape future discussions, formulate policies, and help guide decision making. The process itself of engaging the government and university partners in a dialogue would increase mutual understanding and provide a good foundation for resolving complex issues in the future.

The NSTC, in this report, is issuing a proposed statement of the principles of the government-university partnership. These were developed through interagency review and discussion that benefitted greatly from the input provided by the university community. It is imperative that a more extensive dialogue take place among all stakeholders before the principles are finalized. In particular, it is especially important that universities become directly involved in these discussions and that the Congress also become engaged. To this end, the NSTC encourages internal university discussions and inter-university deliberations, in addition to the dialogue that will be facilitated by the NSTC between the government and university partners and any congressional deliberations that might occur.

The goal of all those involved in these discussions should be to foster an environment that promotes scientific discovery, technological innovation, and the development of the next generation of scientists and engineers. Government actions should be guided by a recognition of the national importance of the American university and by a desire to sustain that special resource for maximum benefit to the nation. It is also important for universities to demonstrate their understanding of the responsibilities to the American public that accompany the acceptance of Federal funds for the conduct of research. Both partners must also be committed to streamlining administrative processes while maintaining effective stewardship of Federal funds.

ACTION: Adopt Statement of Principles of the Government-University Partnership

- The NSTC proposes a statement of principles of the government-university partnership to clarify the roles, responsibilities, and expectations of the parties—funding agencies, universities, individual investigators, and regulatory bodies—and to provide a framework for the development of new policies, rules, regulations, and laws affecting the partnership. The NSTC statement of principles serves as a basis for further dialogue among interested parties, including government and universities, and should be finalized by the NSTC within twelve months. The dialogue will be facilitated by publication of the NSTC principles in the *Federal Register* for public comment; and through discussions and interactions with a variety of stakeholders, including the Congress, university associations and professional societies, the National Academy of Sciences, the National Science Board, and the Federal Demonstration Partnership.

PROPOSED STATEMENT OF PRINCIPLES

The following are guiding principles that govern interactions between the Federal government and universities that perform research.

1. GUIDING PRINCIPLES

- ***Research Is an Investment in the Future.***

  Government sponsorship of university research—including the capacity to perform research and the training of the next generation of scientists and engineers—is an investment in the future of the nation, helping to assure the health, security, and quality of life of our citizens. Government investments recognize that the expected benefits of research often accrue beyond the investment horizons of corporations or other private sponsors. Investments in research are managed as a portfolio, with a focus on aggregate returns; investments in individual research efforts that make up the portfolio are based on the prospects for their technical success, though not on a presumption that those outcomes can be predicted precisely.

- ***The Linkage Between Research and Education Is Vital.***

  The integration of research and education is the hallmark and strength of our nation's universities. Students (undergraduates as well as graduates) who participate in Federally sponsored research grow intellectually even as they contribute to the research enterprise. Upon graduation, they are prepared to contribute to the advancement of national goals and to educate subsequent generations of scientists and engineers. Their intellectual development and scientific contributions are among the important benefits to the Nation of Federal support for research conducted at universities. There should be compelling policy reasons for creating or perpetuating financial or operational distinctions between research and education. Our scientific and engineering enterprise is further enhanced by the intellectual stimulation brought to campus by students from varying cultural, ethnic, and socioeconomic origins.

- ***Excellence Is Promoted When Investments are Guided by Merit Review.***

  Excellence in science and engineering is promoted by making awards on the basis of merit. Merit review assesses the quality of the proposed research or project and is often used in combination with a competitive process to determine the allocation of funds for research. Merit review relies on the informed advice of qualified individuals who are independent of those individuals proposing the research. A well-designed merit review system rewards quality and productivity in research, and can accommodate endeavors that are high-risk and have potential for high gain.

- ***Research Must Be Conducted with Integrity.***

  The ethical obligations entailed in accepting public funds and in the conduct of research are of the highest order and recipients must consider the use of these funds as a trust. Great care must be taken to "do no harm" and to act with integrity. The credibility of the entire enterprise relies on the integrity of each of its participants.

2. OPERATING PRINCIPLES

The following operating principles are intended to assist agencies, universities, individual investigators, and auditing and regulatory bodies in implementing the guiding principles.

- ***Agency Cost Sharing Policies and Practices Must be Transparent.***

  As in any investment partnership, each partner contributes to the research endeavor. While the primary contribution of universities is the intellectual capital of the researchers' ideas, knowledge, and creativity, it is sometimes appropriate for universities to share in the costs of the research (and in some cases cost sharing is required by statute). Cost sharing can be appropriate when there are compelling policy reasons for it, such as in programs whose principal purpose is to build infrastructure and enhance an awardee's institution's ability to compete for future Federal awards. Cost sharing is rarely appropriate when an awardee is acting solely as a supplier of goods or services to the government since this would entail a university subsidy of goods purchased by the government. If agency funds are not sufficient to cover the costs of a research project, the agency and the university should re-examine the scope of the project, unless there are compelling policy reasons to require university cost sharing. Agencies should be clear about their cost sharing policies and announce when and how cost sharing will figure in selection processes, including explicit information regarding the amount of cost sharing expected.

- ***Partners Should Respect the Merit Review Process.***

Excellence in science is promoted when all parties adhere to merit review as the basis for distributing Federal funds for research projects and refrain from seeking Federal funds through non-merit- based means. Federal investments in research are made with the expectation that the research community will select promising research paths more productively and wisely by relying on merit review than can a process that bypasses merit review to directly fund a specific individual or institution. Success in obtaining funds outside the merit review system can be discouraging to researchers who participate in the process. Most significantly, bypassing merit review threatens to undermine research excellence. Merit review may be used in conjunction with other selection criteria to support agency or program goals.

- ***Agencies and Universities Should Manage Research in a Cost-Efficient Manner.***

The goal of all those involved in sponsoring, performing, administering, regulating, and auditing university-based research and associated educational activities of the research enterprise should be to make maximum resources available for the performance of research and education. This goal can be accomplished by keeping agencies' and universities' costs of compliance with Federal requirements to the minimum required for good stewardship of Federal funds. For example, administrative requirements should rely on the least burdensome and least costly methods that can effectively provide needed stewardship. Universities should likewise manage their Federal grants as efficiently as possible.

- ***Accountability and Accounting Are Not the Same.***

The principal measure of accountability must be research outcomes: have the researchers carried out a program of research consistent with their commitment to the government? Financial accountability is also important and should assure research sponsors that Federal funds have been used properly to achieve the goals of the research in a cost effective manner. Federal agencies must ensure that financial accountability requirements are limited to those that are reasonably required for good stewardship and that each measure adds sufficient value in terms of increased stewardship to justify the burdens and costs it imposes on universities and agencies.

- ***The Benefits of Simplicity in Policies and Practices Should Be Weighed Against the Costs.***

The costs and benefits of simplicity in regulatory, administrative, cost accounting, and auditing practices should be assessed against the costs and benefits of accommodating diverse Federal programs and the multiplicity of university organizational structures in determining best policies and practices. "One size fits all," or uniformity for uniformity's sake, can unintentionally increase requirements and burdens, but a multiplicity of practices can also be costly. These tradeoffs should be carefully assessed whenever changes in government-wide or agency-specific policies and practices are proposed.

- ***Change Should be Justified by Need and the Process Made Transparent.***

The process of change in the government-university partnership should be made as transparent as possible. Modifications in administrative, regulatory, or auditing requirements, or in cost sharing expectations, should be kept as infrequent as possible, consistent with the need to respond to changing circumstances. The impact of change in one part of the system should be understood relative to the whole. Reasonable time should be allowed for both agencies and universities to adapt to change.

CHAPTER 4

INTEGRATION OF RESEARCH AND EDUCATION

The Federal government, through its agencies, has long recognized the importance of supporting the development of highly trained scientists and engineers through the research enterprise. Research was being conducted in private universities even before the Morrill Land-Grant College Act of 1862, which provided for the establishment in every state of universities to conduct scientific research and teach "branches of learning as are related to agriculture and the mechanic arts." More recently, Vannevar Bush's 1945 report stated that it should be one of the nation's highest priorities to maintain a continuous supply of well-trained scientists and engineers to address the nation's evolving science and technology agenda. The importance of making a scientific education accessible to a diverse student population and of ensuring strong research-intensive universities in all regions of the United States is recognized through such programs as EPSCoR (Experimental Programs to Stimulate Competitive Research) and by support of Historically Black Colleges and Universities and Hispanic-Serving Institutions. Students emerge from their research training to embark on research careers in universities, industry, and government, others become integral to directing and managing the high-technology economy, and many also become involved in public policy as citizens, public advocates, and policymakers. They collectively make major contributions to public health and safety, national security, environmental quality, agricultural productivity, quality of life, and international economic competitiveness.

The integration of research and education is the hallmark and strength of our research and education system. Indeed, an important rationale for the Federal investment in university-based research is the benefit derived from training a new generation of scientists and engineers. The proximity and integration of the research and education functions enables a continuous process of mutual enrichment. Most Federal agencies also consider education and training of students who become familiar with issues of importance to that agency to be one of the major benefits of their research partnership with universities. Students who assist in Federally sponsored research projects simultaneously satisfy their educational requirements while providing an important contribution to the national research enterprise. Because it is integrated with education, university research not only generates knowledge and understanding, but is also therefore a wellspring of new science and engineering talent. The findings of the recent National Science Board report on "The Federal Role in Science and Engineering Graduate and Postdoctoral Education" reaffirm the importance of the link between research and education.

The vital and dual roles of students as both researchers, who contribute to the national research enterprise, and as students, who gain research experience as part of their training as future scientists and engineers, must be recognized and reflected in government policies and practices. Dividing the research and education enterprise into financial or operational component parts reduces the effectiveness of the enterprise as a whole. To the extent that Federal requirements encourage such distinctions, they should be re-examined and possibly modified to

ensure that the linkage between research and education is as clear as possible. Artificial distinctions that characterize students as either students or employees, rather than as students and employees, for example, send the wrong message about national priorities and lead to misunderstanding about the role of students in Federally funded research projects. A student should be eligible for support on a Federal research grant on the basis of the benefits that individual brings to the research project, and not on whether the university defines the individual as a student or as an employee.

The scientific and technological advances that keep our nation at the forefront of economic progress, military preparedness, health care and quality of life for our citizens depend upon a highly educated and motivated workforce. Developing such a workforce requires that the best and the brightest students from varying cultural, ethnic, and socioeconomic origins are prepared for careers in science and technology and that they choose to pursue such careers. We must engage the natural curiosity of all our young people, from all backgrounds and areas of the country, in science and engineering. It was with these considerations in mind that the NSTC established an interagency working group on the "U.S. Science and Technology Workforce of the Future." The working group is analyzing the impact of demographic and socio-economic changes on the S&T workforce and will make recommendations for how the Federal government can increase the participation of women and minorities who are currently under-represented in the workforce.

The linkage between education and research must begin before students reach college and be reinforced at the undergraduate level if it is to be effective in ensuring the flow of our best and brightest into science and engineering disciplines. Undergraduates, as well as graduate students, should have the opportunity for regular exposure to senior research faculty and for engagement in meaningful scientific or engineering research. Such programs can contribute to a scientifically literate population and help provide the foundation for educating future scientists and engineers. NSTC encourages partnerships among schools (K-12), research intensive industry, universities, and Federal Laboratories to give students and teachers exposure to research and to better understand its role in our society.

As we look toward the next century, we see a world in which all citizens will need a high level of scientific and technological literacy to succeed. Attaining this level of proficiency will require improved training for K-12 teachers of mathematics and science, which in turn requires research to improve our understanding about the learning process. Universities are encouraged to help raise the quality of K-12 education in their own communities and in the communities from which they draw their undergraduates. The missions of several Federal agencies include education objectives at the K-12 and undergraduate, as well as at the graduate and postdoctoral levels. Increased science and math study opportunities for non-traditional students, such as those returning to school for mid-career retraining, are also important in attaining a scientific and technically literate population and workforce. The Federal government's partnership with universities, while not always entailing specific educational obligations, can contribute significantly to human resource development at all levels. The Interagency Education Research Initiative, in its second year, is such an initiative, providing substantial support for large-scale, interdisciplinary university-based research that will lead to improved teaching and learning

through better understanding of K-12 learning in reading and mathematics and K-12 teacher education.

ACTIONS: Reaffirm the Importance of the Integration of Research and Education and Strengthen the Linkages in Practice

- The NSTC reaffirms the importance to the nation, the research enterprise, and the future scientific and engineering workforce of linking education and research. Federal agencies and universities are encouraged to explore mechanisms and to experiment with programs that catalyze the integration of research and education on campus and aid students in their transition from students to members of the scientific and engineering workforce.

- The NSTC will review government policies and practices to ensure that agencies are able to support students in a manner consistent with their dual roles as researchers and students, and recommend changes as necessary. The NSTC will provide the results of the review and recommendations to the appropriate Federal agencies within twelve months of this report.

CHAPTER 5

ACTIONS TO STRENGTHEN THE PARTNERSHIP

The review identified a number of actions that would help make the partnership more effective and efficient.

1. Research Integrity

Issue: Although a number of Federal agencies have policies regarding research misconduct, not all do, and variations in policy and practice send mixed signals to universities regarding Federal interests in this area. The interests of the Federal government will be advanced if greater uniformity can be brought to Federal policies in this area and universities will find more consistency in their interactions with government agencies.

Discussion: As a major funder, producer, and user of research, the Federal government has a vital interest in the integrity of the research record. Advances in science and engineering depend on the reliability of the record as do the benefits associated with them in areas such as health and national security. Sustained public trust in the scientific and engineering enterprise also requires confidence in the record and in the processes involved in its ongoing development. There will be occasions when it will be alleged that an individual researcher has failed to act in accordance with values of the scientific and engineering enterprise, values essential to public confidence in the enterprise and the integrity of the research record. In such cases, the Federal government must have clearly stated policies defining the circumstances under which it will consider that research misconduct has occurred in the course of Federally funded research, and guidelines for addressing such allegations.

ACTION: Institute Uniform Government Policies and Practices for Research Misconduct

- The NSTC will complete the process initiated in 1996 to develop a government-wide definition of research misconduct and guidelines for handling cases of alleged research misconduct. The policy will affect all research funded by the Federal government, including both intramural research and extramural research funded through universities, non-profit organizations, and the private sector. Agencies will have twelve months to implement the new policy once it is finalized.

2. Merit Review

Issue: Although most parties would agree with the principle that excellence is promoted by rewarding merit, exceptions to merit review do occur in awarding research funds. It is in the interest of both the universities and the Federal government to ensure that merit review is well understood by the stakeholders, and to maintain the integrity of the process.

Discussion: Both universities and the Federal government need to be able to explain how funding decisions are made. When universities or other organizations seek research funds though non-merit-based means, the integrity of the enterprise suffers, which could ultimately undermine support for Federally-funded research. Both partners should seek ways to explain and defend the merit-review process, and to ensure that awards made outside of the merit review process decrease over time.

ACTION: Clarify and Extend Use of Merit Review in Awarding Research Funds

- The NSTC reaffirms the principle of merit review in awarding research funds.
- The NSTC supports OMB's effort to refine the definition of merit review in its annual revision of the terms in OMB Circular A-11, "Preparation and Submission of Budget Estimates (part 1)."
- The NSTC will examine ways to extend agency application of merit review in awarding research funds and seek ways to decrease practices that bypass the process.

3. Cost Sharing Policies and Practices

Issue: Cost sharing, as defined in OMB Circular A-110, "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and other Non-Profit Organizations," is that portion of project or program costs not borne by the Federal government. With the exception of cost sharing that is required by law, agencies vary in their approaches to cost sharing and most do not have explicitly articulated, agency-wide policies. Individual program managers therefore often make decisions on a program-by-program basis. Actions taken by program managers may make sense from an individual program perspective—cost sharing can be a means of maximizing the number of awards within limited budgets—but the cost/benefit analysis may look different from an agency or even a national perspective. Universities have four principal sources from which to draw funds to support their activities. These are tuition, gifts, Federal funds, and state funds in the case of state universities. Ad hoc cost sharing practices can have a detrimental impact on the university research and education

system as a whole (for example, by drawing funds for research from sources that would otherwise support undergraduate education). And while it can be in the government's interest to accept universities' offers to share in the costs of research in cases where it is not required, certain accounting rules tend to discourage universities from volunteering to do so.

Discussion: A number of issues identified by this review merit action:

- *Lack of clarity about agency cost sharing expectations creates difficulties.*

Universities have indicated that lack of clarity about agency cost sharing expectations reduces their ability to plan financially. Unaware of an agency's cost sharing expectations, a university may be caught short if it has submitted a proposal in response to a program announcement but does not learn in a timely way about the agency's cost sharing expectations. Without knowing the "rules of the game," a university may be outbid by another and lose the award, or an agency may not receive the optimum level of cost sharing that it seeks. To avoid these difficulties, and to ensure a level playing field, it would be helpful if agencies announced, in advance, as part of their request for proposals in program announcements, if cost sharing is a criterion of award selection, and how, including explicit information regarding the amount of cost sharing expected and about the process by which cost sharing will be considered.

- *The Federal requirement that institutions absorb the overhead costs associated with voluntary sharing in the direct costs of a research project can create a disincentive against voluntary contributions of faculty time.*

OMB Circular A-21 requires that all university research activities, regardless of their source of support (Federal, university, or private sponsor) be included in calculating total research costs. These total costs provide the basis for calculating the university's Facilities and Administration (F&A) rate (also called indirect rate) and for determining the share of the F&A costs for which the Federal government will reimburse the university (the share is based on the portion of the total research that is supported by the Federal government). Consequently, when a faculty member who wishes to invest more time on a research project than already agreed to in the research proposal or than is required by the Federal agency as cost sharing, the time must still be accounted for in the base of "organized research" for the purpose of computing the indirect cost rate. Universities regard this requirement as a double penalty; not only does the university bear the costs of the direct charges for faculty time spent on the project above that expected, but including those direct costs in the base of organized research decreases the F&A rate for the school for all projects.

The Federal government's intent in requiring this accounting practice is to ensure that the overhead costs related to research activities (whether they are funded by the Federal government or by the institutions) are allocated to the benefitting activities. But it is worth noting that this level of precision in accounting normally will not fully account for faculty time beyond that required by the faculty member's employment agreement with the institution. Moreover, faculty

donate time to other activities that are central to the working of the research enterprise, yet this donated time is not a factor in calculating F&A rates, nor should it be, as these duties are rightly considered by the university as part of the faculty's responsibilities. For example, agencies rely extensively on the expertise of university scientists and engineers to serve on agency advisory panels, peer review panels, and committees, often with no compensation, providing critical input that enables agencies to shape their research agenda and foster research excellence. Such activities are vital to the functioning of the partnership; indeed, they are central to it.

- *Limitations on institutional reimbursement of research costs on otherwise allowable costs should be reviewed.*

Mandatory cost sharing stems from Federal cost principles and some statutes that limit institutions' recovery of costs that are otherwise reimbursable, including limitations on indirect cost rates established by legislation. An issue of current concern to some agencies and universities involves the cap on administrative costs as it impacts universities that administer R&D laboratories for Federal agencies or have other relationships with the government that have procurement aspects. For relationships that are solely procurement in nature, the cap on administrative costs inappropriately forces universities to share in the administrative costs for the goods and services purchased by those agencies (unless the university's administrative costs are at or below the cap).

ACTIONS: Clarify or Amend Cost Sharing Policies and Practices

- The NSTC will explore mechanisms by which agencies might more clearly and consistently communicate information to universities about their cost sharing policies, practices, and expectations. One option might be to require that agencies announce when and how cost sharing will figure in selection processes and include information about the amount of cost sharing expected. Options should be drafted within twelve months of this report.

- The NSTC will assess the impact of accounting practices on voluntary cost sharing by universities, particularly as it relates to the donation of faculty time to research projects. The review (including data collection) should be completed and recommendations issued within twelve months of this report.

- The NSTC will assess the impact of provisions that limit reimbursement of research costs on otherwise allowable costs, and in particular, the impact of these cost reimbursement policies on government-university relationships that have procurement aspects. The review (including data collection) should be completed and recommendations issued within twelve months of this report.

4. Grants Administration

Issue: Differences in policy and practice across Federal agencies oblige institutions of higher education to maintain separate internal operating procedures for each agency with which they conduct business. Programmatic variations among agencies may justify some of these differences. However, opportunities to streamline excessive requirements could save time and resources for universities as well as for Federal agencies.

Discussion: More uniform policies and procedures for the administration of Federal research project grants can reduce paperwork and free faculty to spend more time on research. The Federal Demonstration Partnership (FDP) has developed standardized grant terms and conditions to apply to all FDP institutions that receive support from FDP agency members. These streamlined standards have helped reduce the burden placed upon researchers and university administrators by narrowing the differences in grants management practices among agencies, but without compromising accountability. However, not all agencies participate in the FDP, and only 65 universities are members. The benefits of streamlined standards and uniform terms and conditions could be extended to those other agencies and universities by making them applicable across all agencies. Agency efforts to reduce agency-specific requirements should also continue.

Broader adoption of standardized procedures should not hinder further streamlining by agencies. Prompted both by the promise of new technology and a desire to reinvent government for better performance, efficiency, and service, Federal agencies are developing a variety of new approaches to grants administration. One example is in the area of electronic research administration (ERA) where the Federal Commons now under development will provide universities a streamlined and consistent electronic interface with the Federal agencies. Another is the "modular grant" concept currently being studied by NIH, in which the investigator is asked to provide a best-estimate-of-cost for a proposed project in $25,000 increments, and which encourages subsequent disengagement from complex budget negotiations. Such agency streamlining efforts should be encouraged and accelerated.

ACTION: Reduce Differences in Grants Administration Across Agencies

- The NSTC will establish an interagency group to develop terms and conditions that will reduce differences in grants administration policy and practice across Federal agencies to the extent consistent with individual agency needs. The general terms and conditions should be based on those developed by the FDP and make maximum use of the expanded authorities included in OMB Circular A-110 for all research and research-related project grants. Where consistent with statute, the NSTC policy will be that all Federal agencies will use the uniform terms and conditions as the default for all research and research-related project grants. These defaults should be overridden only when there are compelling reasons to do so. These actions should be implemented within twelve months of this report.

- The NSTC encourages agencies to continue reducing agency-specific requirements, consistent with their missions. Related to this, agencies should work together to coordinate a "common face" to the university research community in the development of ERA systems.

5. Federally-Mandated Changes in University Business Practices

Issue: Universities have expressed serious concerns about the cumulative impact of Federally mandated requirements in business practices. For example, the implementation of Cost Accounting Standards (CAS) by the Cost Accounting Standards Board imposed administrative burden on universities, while provisions in OMB Circular A-21 place limits on the recovery of both administrative costs and other costs associated with operating the research enterprise.

Discussion: The implementation of CAS is an example of what can happen when Federally mandated business practices are implemented without consideration of their cumulative impact. In 1996, OMB incorporated the requirement to comply with four cost accounting standards in OMB Circular A-21, and, for institutions with Federally sponsored agreements totaling $25 million or more, the requirement to file a Disclosure Statement. The latter describes the cost accounting practices of the institution, and provides the cognizant Federal agency the ability to determine whether the institution is in compliance with the CAS.

The university community strongly opposed the implementation of CAS. Officials in both the university and government communities question whether CAS is appropriate given that universities often share in the costs of research, not only as a result of the administrative cap, but as a result of a variety of legislatively mandated cost sharing and other practices.

Taken in isolation, the CAS requirements reflect sound business practice. Yet questions about their efficacy are raised when they are considered in the larger context in which universities operate. For example, the costs of CAS implementation are recoverable under Federal contracts with commercial concerns, but they are not for universities (at least if their administrative costs are above the A-21 mandated cap on administrative costs.) There are other important differences between the treatment of commercial concerns and universities under CAS that should not be overlooked in the future when changes in accounting practices are proposed. In the commercial arena, adjustments are made in contracts when cost recovery is affected by government changes in cost accounting. For universities, however, where the government favors multi-year F&A rates, changes in recovery can only be made at the time the new F&A rate is renegotiated. More importantly, Federal sponsoring agencies rarely increase the overall value of sponsored agreements to accommodate increases in F&A rates.

ACTION: Establish Mechanism to Review Impact of Proposed Changes in Business Practices

- The NSTC will consider the establishment of more effective mechanisms for reviewing government business policies and practices, both current and prospective, with respect to sponsored research to consider their relationship to each other, assess their impact on research, and determine their compatibility with university processes.

6. Regulation of Research

The review identified two areas where regulatory and administrative reform should be considered: the system of certifications and assurances by which universities demonstrate compliance with applicable national policies, and mechanisms for ensuring good environmental stewardship.

Certifications and Assurances

Issue: Certifications and assurances are used by agencies to obtain institutional and individual agreement to comply with the relevant national policy requirements. The two mechanisms are implemented and enforced differently, creating administrative complexity, yet a single mechanism might suffice.

Discussion: Universities are subject to many national policy requirements by virtue of receiving Federal grants and contracts. The requirements originate in approximately thirty statutes, Executive Orders, treaties and conventions, and are often further delineated in implementing regulations. Examples of current requirements are those concerning nondiscrimination on the basis of race, color, national origin, religion, sex, age, or handicap; the treatment of live organisms, including humans and animals; and environmental quality.

Awardees provide assurances to Federal agencies of their compliance with applicable national policy requirements by their acknowledgment of the terms and conditions of the award. Failure to comply can result in suspension of further payments by the agency under the award or termination of the entire award, if necessary.

For a few national policy requirements, agencies are required by statute or government wide regulation to obtain a certification, which is a signed declaration testifying to the recipient's compliance with a national policy requirement. Institutions become liable for criminal penalties by virtue of certifying compliance with a national policy requirement, even if the failure to comply with the national policy itself is not subject to such penalties; these are more severe penalties than the penalties associated with failure to comply with assurances. Only three national policies mandate the use of certifications by statute or government-wide regulation. These are associated with the requirements of the Drug-Free Workplace Act; debarment and

suspension rules; and the prohibition against the use of Federal funds for lobbying as required by law (31 U.S.C. 1352).

The three national policies for which certifications are required are as important, but do not appear to be more important, than the national policy requirements Federal agencies address using assurances. Replacing these certifications with assurances would reduce administrative complexity and paperwork for both Federal agencies and awardees and facilitate the use of electronic research administration. Relying on assurances would remove disparities in the penalties associated with certifications and assurances.

In addition to the question discussed above, whether assurances can be used in lieu of certifications for the few national policies that currently require certifications, there is a second question: can certifications and assurances be handled more efficiently on an institutional basis, rather than separately for each individual Federal award? Universities and other research performers comply with most national policy requirements for which certifications and assurances are required through institution-wide policies, procedures, and internal controls, rather than by taking actions specific to each award. Obtaining awardees' commitments on an institutional basis, rather than requesting the identical commitment each time a potential awardee submits a proposal, would reduce paperwork for Federal agencies, universities, and other awardees, especially since only a fraction of the proposals or applications are selected for awards.

ACTION: Streamline Certification and Assurances Requirements

- The NSTC will identify the appropriate agencies to conduct review of certification requirements in order to: determine those which might be replaced by assurances of compliance with national policies; identify those for which institutional certifications or assurances might be more appropriate (via electronic means if possible) than grant-by grant assurances; prepare a policy, for incorporation into the appropriate government-wide document, that directs agencies to impose agency-specific certification requirements only when required by law or if the agency head determines that there is added value that justifies using certifications rather than assurances; recommend necessary changes (including possible legislative changes) in current certification requirements. This action may implicate more than universities and the agencies that fund them, and appropriate government entities will be consulted as appropriate. The results of the review and recommendations should be issued within twelve months of this report.

Promoting Excellent Science and Environmental Stewardship

Issue: Over the past few decades the Federal government has established national environmental standards applicable to all sectors of the U.S. economy. Some research laboratories and industrial firms have developed tailored, laboratory-based environmental and safety management systems that sometimes exceed the relevant state and Federal levels of protection required by law, even resulting in lower cost, improved research productivity, improved employee safety and health, and better protection for the environment. Implicit in this approach is the recognition that ensuring safety and environmental protection is not just a matter of compliance with regulations, but is consistent with "doing good science. "

Discussion: Recent environmental, health and safety incidents at U.S. research laboratories remind the scientific community that excellent science must also be safe science. Safety and environmental protection measures must be integral to research activities; every scientist and engineer is responsible for designing such measures into their research and for ensuring that students working with them are educated and protected about the risks involved in working in a laboratory. Scientists, engineers, and research laboratories funded by the government should strive to be exemplary in this regard.

Many industrial firms have adopted environmental standards that are more stringent than state and Federal environmental regulations, with research laboratories following suit, adopting protocols that are tailored to the working practices of their individual organizations and that ensure that relevant regulations are met. Examples include the adoption of "microscale chemistry" techniques that can reduce the quantity of resources needed and waste generated by an order of magnitude or more. By basing decisions and operating procedures on the full life-cycle cost, these laboratories have been able to create a research environment that improves worker safety and stretches limited research dollars by greatly reducing the need to dispose of and remediate wastes.

The Federal government recently has instituted a number of pilot programs that enable compliance with various environmental rules and regulations through a more flexible, tailored, and systemic approach that targets waste reduction, safety, and environmental protection rather than specific regulations, one by one. Such programs are a step in the right direction, but they will only reach their full potential when they are expanded and when a streamlined application process is instituted for them. Moreover, the Federal government needs to do more to incorporate the lessons learned from these experiments into new and revised Federal environmental regulations, which would lead to the creation of more responsive, tailored, and effective programs for environmental, health, and safety management systems.

This issue has been analyzed by a number of organizations, including the Government-University-Industry Research Roundtable, which convened a meeting on the subject in 1991 of health and safety officers from university, industry, and government laboratories. The Roundtable concluded that means of improving waste-handling methods for research laboratories

should be investigated that would reduce the volume of waste, eliminate nonproductive requirements, increase awareness about the importance of proper waste management, and enhance communication among all relevant parties. The NSTC considers this an important issue and believes that the establishment of an ongoing dialogue between research performers, state and Federal regulators, and the Federal agencies that support scientific research would be a productive way to disseminate these best practices and to identify any barriers to the adoption of these best practices. Any barriers that are the result of Federal environmental laws should be documented and resolved as these Federal laws come up for their periodic renewal.

ACTION: Strengthen Environmental Protection in Research Laboratory Setting

- After consulting with the appropriate agencies, the NSTC will determine the best way to organize discussion among the nation's universities, Federal and industrial research laboratories, Federal and state regulators, and Federal science agencies to identify best practices for integrating environment, safety, and health responsibilities with the conduct of research. This discussion would serve as a forum for disseminating best practices to a wider community. It would also serve as a forum for identifying lessons learned and impediments to the adoption of these practices that should be incorporated into new and revised Federal and state regulations. This forum should be established within six months of the issuance of this report, and annual progress reports should be produced, demonstrating progress.

CHAPTER 6

IV. CONCLUSION

The purpose of this review is to better understand the government-university partnership in research and associated educational activities, and to identify issues requiring action or further study. No review or set of actions is likely to identify all relevant issues or anticipate all future issues. The government-university partnership is too dynamic and involves too many participants to allow for such an outcome. Since at best such an exercise can provide a snapshot of the partnership at any given time, a mechanism or mechanisms should be established to provide for continuing review and assessment by universities, the Federal government, and other interested parties, so that issues may be addressed as they arise. This will help support and strengthen the partnership so that it can continue to promote mutual goals.

ACTION: Establish Task Force to Provide for Continuing Dialogue and Review

- The NSTC will establish a standing interagency working group under the auspices of the Committee on Science dedicated to continuing review and assessment of the government-university partnership. The NSTC urges the President's Committee of Advisors on Science and Technology to consider the establishment of a panel for the same purpose, to consult with universities and other interested parties, and to provide advice to the President and the NSTC on the government-university partnership. These entities would complement the activities of already existing organizations, such as the Federal Demonstration Partnership, the Government-University-Industry Research Roundtable, and the National Science Board. Potential areas meriting further review include the following: the process for assigning intellectual property rights in the case of university-industry-government research collaborations; identification of best practices of individual universities or Federal agencies that could be disseminated for broader use to improve the partnership; resources required to meet the terms of the OMB advisory that requires grantee mission-critical systems to be Y2K—or year 2000—compliant. Other topics will be identified and assessed as appropriate.

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Appendix B

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ABSTRACT

At the urging of the President's Committee of Advisors on Science and Technology, state governors, industry leaders, elected officials, and leaders in education, the Assistant to the President for Science and Technology issued a Presidential Review Directive in September 1996, directing the National Science and Technology Council (NSTC) to review the government-university partnership in research and associated educational activities, and to recommend ways to strengthen it. The goal was to assess and reaffirm the principles of the partnership, promote cost-effective university-based research, ensure fair allocation of research costs, and support the linkage between research and education, all while maintaining appropriate accountability for expenditure of public funds. Where appropriate, the findings and recommendations emerging from this review also apply to nonprofit independent research institutes.

The review was carried out by a multiagency Task Force under the auspices of the NSTC Committee on Science. The Task Force solicited the views of universities, university associations, and the Federal research agencies regarding the issues they considered most pressing. These responses provided the basis for the interagency discussions and for the report's findings and recommendations.

The NSTC finds that the partnership is sound and continues to serve the nation in important ways. The NSTC identified a number of areas in which the partnership can be strengthened and will take action in three areas. ***First***, the NSTC is issuing a proposed statement of the principles of the partnership to clarify the roles, responsibilities, and expectations of the parties and provide a framework for the development and analysis of future policies, rules, regulations, and laws. The principles will be finalized, in consultation with universities and other interested parties, including the Congress, within twelve months from the date this report is issued. ***Second***, the NSTC reaffirms the importance to the nation, to the research enterprise, and to the future scientific and engineering workforce, of the linkage between research and education. The NSTC will take actions to strengthen this linkage, and urges universities to do likewise. ***Third***, the NSTC, through the Federal agencies that fund university-based research, will implement a set of actions to help make the partnership more effective and efficient. ***Finally***, the NSTC will establish a mechanism to provide for ongoing review of the partnership.

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